Final Report

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Survey of Durum Production Practices

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Survey of Durum Production Practices, 2004

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Summary

Durum growers were surveyed in cooperation with the Arizona Agricultural Statistics Service to determine production practices and their effects on yield and protein in the 2004 growing season. The survey was conducted in two regions: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions represent about 96% of the durum acreage. We obtained responses from 91 out of an estimated 195 durum growers (47%) representing about 38,000 out of 95,500 acres (40%). Durum was grown following cotton (48%), vegetables (43%), or other crops. The predominant soil texture was a sandy loam (36%), followed by clay loam (26%) and sandy clay loam (26%). Herbicide was applied on 67% of the acreage. The major varieties were Kronos (20%), WestBred 881 (18%), Kofa (14%), and Duraking (11%). Border flood irrigation accounted for 77% of the acreage, followed by furrow (11%), and level basin (10%). The crop was typically irrigated 6 to 7 times. The average planting date (irrigation applied) was December 19 in the Central region and January 7 in the West region. The seed was planted at an average rate of 163 lbs/acre. Phosphorus was applied to only a third of the acreage, but when it was applied, the rate averaged 67 lbs P_2O_5/acre. Nitrogen rate averaged 210 lbs N/acre. Grain yield tended to be higher following crops other than cotton grown on clay loam to sandy clay loam soils. Increased yield was associated with early planting, certain varieties, and irrigation frequency. Higher protein content was associated with previous crops other than cotton, border irrigation, early planting, and N rate. This survey documents associations, not cause-and-effect relationships, among durum production practices, yield, and protein.

Introduction

Research on agricultural practices has traditionally been done in small plots by varying one aspect of management, called the treatment, and keeping all else constant. Clear conclusions can be drawn using this approach, but the applicability of the results is limited to the specific location and set of growing conditions. A method of conducting research that allows wider applicability of results is to correlate agricultural practices and yield from a large number of fields. The question is often asked how the top producers obtain high grain yield and protein. The problem with this approach is the accuracy of the information provided and the fact that correlation does not establish a cause-and-effect relationship. Nevertheless, some useful knowledge may be gained using survey methodology.

Procedures

A survey of durum production practices in 2004 was developed and sent to growers in two regions of Arizona: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions contained about 95,500 of the 99,000 acres of durum in the state in 2004, or about 96% of the durum acreage. We obtained responses from 91 out of an estimated 195 durum growers (47%) representing about 38,000 out of 95,500 acres (40%). Depending on the variable, 75 to 84 of the responses were useable since some values were either missing or out of range. The information requested on the survey included town, previous crop, variety, herbicide applied, irrigation system, soil texture, planting date, seeding rate, fertilizer application, and number of irrigations applied. The survey responses were statistically analyzed using analysis of variance.

Results and Discussion

Durum acreage in 2004 was roughly split between the West (56%) and Central (44%) regions, and grain yield and protein in these regions was not significantly different (Table 1). The county with the greatest percentage of the acreage was Yuma (36%) followed by Pinal (22%) and Maricopa (18%). Grain yield was highest in Yuma and Pinal Counties, and grain protein was lowest in Maricopa County.

About half (48%) of the durum was planted after cotton and the other half after vegetables and other crops. When the previous crop was cotton, durum yield and protein were lower compared to other previous crops.

The predominant varieties in terms of percentage of acreage were Kronos (20%), WestBred 881 (18%), Kofa (14%), and Duraking (11%). Many varieties were grown in both regions, but some such as Kofa and Alamo were only grown in the West region and others such as Ocotillo and Crown were only grown in the Central region. The highest yielding varieties were Duraking in the West region and Mohawk in the Central region. We were not able to detect differences in grain protein concentration among varieties.

Herbicide was usually applied to most of the acreage in the West region, whereas only about half of the acreage in the Central region received a herbicide application. Herbicide application did not affect yield or protein.

The predominant irrigation system is border flood (77%) followed by furrow mainly in the Central region (11%) and level basin mainly in the West region (10%). Some of the respondents with level basin irrigation systems may have listed their irrigation system as border flood. We found no relationship between irrigation system and grain yield, but higher grain protein was associated with border flood than furrow or level basin irrigation.

Durum was grown predominantly on sandy loam soil (36%) followed by clay loam (26%) and sandy clay loam (26%) soil. Most of the clay loam soil was in the West region. Grain yield was lower on sandy loam soil compared with the heavier soil textures, clay loam and sandy clay loam.

The average planting date was January 7 in the West region and December 19 in the Central region. February plantings were associated with lower grain yield in the West region. In the Central region, higher protein was observed in the December than January plantings.

The average seeding rate was 163 lbs seed/acre. No differences in yield or protein could be attributed to seeding rate.

The average nitrogen rate was 210 lbs N/acre. In the West region, the highest protein content was associated with nitrogen rates between 100 – 199 lbs N/acre. In the Central region, the highest yields were associated with nitrogen rates between 300 – 499 lbs N/acre. The response of the durum crop to nitrogen fertilizer depends on several factors that were not included in this survey such as manure application and soil nitrogen content.

Only about a third of the durum acreage received P fertilizer, but a higher percentage of the acreage in the Central region received P fertilizer than in the West region presumably due to adequate soil P in the West from vegetable production. When P fertilizer was applied, the average phosphorus rate was 67 lbs P_2O_5/acre. Application of P fertilizer in the Central region was associated with slightly higher grain yield, but again, response to P fertilizer is also influenced by other factors such as manure and soil P.

The average number of irrigations applied was 6.5. The number of irrigations applied was associated with yield in both regions. In the West, grain yield increased as number of irrigations increased to seven, but decreased if more than seven irrigations were applied. This trend may not be directly affected by irrigation number, but by the fact that fewer irrigations are applied to later plantings and more irrigations are applied to lighter soils, both of which are associated with lower yields. In the Central region, increased irrigation frequency is associated with higher yields.

This survey has shown that there are some associations between the various durum production practices and grain yield and protein, but these associations do not imply a cause-and-effect relationship. Side by side comparisons are the best way to evaluate the direct effect of varieties, fertilizer rates, or irrigation practices. Nevertheless, there

appears to be an association between higher yields and previous crops other than cotton, certain varieties, clay loam or sandy clay loam soil texture, early planting, high N rate, and irrigation number. Grain protein was associated with previous crops other than cotton, border flood irrigation, early planting, and N rate.

Acknowledgements

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Table 1. Number of survey respondents (N), grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Region												
West	43	6022	14.0	56	---	---	---	---	43	6022	14.0	56
Central	---	---	---	---	41	5834	13.6	44	41	5834	13.6	44
Significance		---	---			---	---			*NS*	*NS*	
County												
Yuma	36	6133	14.0	43	---	---	---	---	36	6133	14.0	43
Pinal	---	---	---	---	22	6008	14.0	23	22	6008	14.0	23
Maricopa	---	---	---	---	18	5645	13.3	15	18	5645	13.3	15
LaPaz	7	5447	14.0	13	---	---	---	---	7	5447	14.0	13
Pima	---	---	---	---	1	5400	12.5	6	1	5400	12.5	6
Significance		---	---			---	---			+	+	
Previous crop												
Cotton	7	5955	13.6	9	36	5768	13.6	40	43	5798	13.6	48
Vegetables	20	6038	13.7	31	---	---	---	---	20	6038	13.7	31
Leaf lettuce	6	5886	14.6	9	---	---	---	---	6	5886	14.6	9
Alfalfa	4	6100	14.8	3	1	7300	13.6	0	5	6340	14.6	3
Fallow	---	---	---	---	2	6000	13.5	3	2	6000	13.5	3
Head lettuce	4	6825	14.4	3	---	---	---	---	4	6825	14.4	3
Corn	---	---	---	---	1	7400	16.0	1	1	7400	16.0	1
Durum	---	---	---	---	1	4850	14.0	1	1	4850	14.0	1
Significance		*NS*	*NS*			*NS*	*NS*			+	+	
Variety												
Kronos	11	6225	13.7	12	12	5708	13.8	8	23	5907	13.8	20
WPB881	8	5467	14.3	10	3	4450	12.8	8	11	5060	13.7	18
Kofa	17	6550	14.0	14	---	---	---	---	17	6550	14.0	14
Duraking	6	7000	15.5	6	4	5867	13.0	6	10	6320	14.7	11
Alamo	10	5762	14.1	9	---	---	---	---	10	5762	14.1	9
Ocotillo	---	---	---	---	11	5443	13.9	7	11	5443	13.9	7
Crown	---	---	---	---	10	5663	13.2	7	10	5663	13.2	7
Mohawk	3	5600	---	3	6	7023	14.5	4	9	6548	14.5	7
Orita	1	---	---	0.4	7	6657	13.6	4	8	6657	13.6	5
Tacna	1	---	---	0.8	---	---	---	---	1	---	---	0.8
Matt	---	---	---	---	1	---	---	0.3	1	---	---	0.3
Platinum	1	---	---	0.3	---	---	---	---	1	---	---	0.3
Experimental	1	---	---	0.2	---	---	---	---	1	---	---	0.2
Significance		*	*NS*			*	*NS*			**	*NS*	

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Herbicide applied												
No	7	5688	14.4	9	22	5872	13.5	24	29	5828	13.7	33
Yes	36	6086	13.9	47	19	5789	13.8	19	55	5984	13.8	67
Significance		*NS*	*NS*			*NS*	*NS*			*NS*	*NS*	
Irrigation system												
Border	35	6034	14.1	46	25	5879	13.9	31	60	5970	14.0	77
Furrow	---	---	---	---	14	5758	13.3	11	14	5758	13.3	11
Level basin	7	5982	13.4	9	2	5795	12.9	1	9	5940	13.3	10
Drip	1	5850	14.0	1	---	---	---	---	1	5850	14.0	1
Significance		*NS*	*NS*			*NS*	+			*NS*	*	
Soil texture												
Sandy loam	12	5963	13.9	18	20	5559	13.5	18	32	5711	13.7	36
Clay loam	16	6123	14.0	21	7	6156	14.0	5	23	6133	14.0	26
Sandy clay loam	9	6196	13.9	10	10	6356	13.5	15	19	6280	13.7	26
Loam	3	5845	13.9	5	1	5500	13.5	1	4	5759	13.8	6
Clay	1	5000	14.5	0	1	5500	13.4	2	2	5250	13.8	2
Silt loam	1	5500	14.0	2	---	---	---	---	1	5500	14.0	2
Sand	---	---	---	---	1	4850	14.0	1	1	4850	14.0	1
Silty clay	1	5600	13.3	1	---	---	---	---	1	5600	13.3	1
Significance		*NS*	*NS*			*NS*	*NS*			*	*NS*	
Planting date												
December	18	6101	14.2	20	29	5904	13.8	28	47	5980	13.9	48
January	17	6148	13.9	28	9	5678	13.0	14	26	5985	13.6	42
February	7	5514	13.3	11	---	---	---	---	7	5514	13.3	11
Significance		**	*NS*			*NS*	+			*	*NS*	
Seeding rate (lbs/a)												
120-135	9	6102	14.3	8	0	---	14.0	0	9	6102	14.3	8
140-155	12	6044	13.6	20	9	6072	13.6	10	21	6056	13.6	29
160-175	11	6138	13.7	14	16	5912	13.6	15	27	6004	13.7	29
180-229	9	5774	14.3	18	12	5590	13.6	16	21	5669	13.9	34
Significance		*NS*	*NS*			*NS*	*NS*			*NS*	*NS*	
Nitrogen rate (lbs N/a)												
0-99	3	5671	13.5	3	7	5866	13.8	10	10	5807	13.7	13
100-199	9	5940	14.7	6	11	5582	13.5	7	20	5743	14.0	14
200-299	25	6098	13.7	36	15	5668	13.8	14	40	5937	13.8	50
300-499	6	6002	14.2	11	8	6463	13.4	13	14	6265	13.7	23
Significance		*NS*	+			*	*NS*			*NS*	*NS*	

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Phosphorus applied												
No	33	6037	13.9	44	19	5751	13.7	21	52	5932	13.8	65
Yes	10	5972	14.1	12	22	5906	13.6	23	32	5926	13.8	35
Significance		*NS*	*NS*			*	*NS*			*NS*	*NS*	
Number of irrigations												
<6	14	5912	13.8	17	6	5951	13.4	12	20	5924	13.6	28
6	13	6215	13.9	18	14	5343	13.6	14	27	5763	13.7	32
7	8	6441	14.2	11	8	5885	13.7	6	16	6163	13.9	17
>7	8	5479	14.1	14	10	6400	13.8	8	18	5991	13.9	22
Significance		*	*NS*			*	*NS*			*	*NS*	
All	43	6022	14.0	56	41	5834	13.6	44	84	5930	13.8	100

Significance: Statistical significance or probability that differences observed are due to chance. NS = not significant at the 10% probability level, + = significant at the 10% probability level, * = significant at the 5% probability level, and ** = significant at the 1% probability level.